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METALLIC COMPOSITION FOR ELECTRICAL CONTACTS AND THE LIKE

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This invention relates to improvement in metallic compositions for electrical contacts and the like.

An object of the invention is to improve the life, current-controlling capacity, and other operative characteristics of contacts formed of composite materials molded in situ on base metal supports and adapted for use without sintering.

Another object is to provide an electrical contact formed of an unalloyed mixture of silver powder and a substance which acts, under molding pressure, to wet the silver particles and provide an efficient binder for the latter, while insuring proper and substantially uniform low contact resistance and non-sticking characteristics of the contact when in use and throughout the useful life thereof.

Another object is to provide pressure molded contacts each consisting of silver and an associated substance which acts to minimize formation of debris as an incident to arcing therebetween when in use.

Another object is to provide a contact material adapted to be readily brought to granular form by the application of heat to facilitate quantitative measuring and other handling thereof preparatory to molding contacts therefrom.

Another object is to provide electrical switch contacts which are substantially lower in cost than contacts formed of pure silver, which will have a much greater length of life than pure silver contacts, and wherein the tendency toward transfer or build-up between the contacts is minimized.

Another object is to provide electrical switch contacts containing conductive components and anti-flux components, which latter are characterized by their substantial insolubility, thermal stability at temperatures up to 1000 degrees F., and their ability when dissociated under the action of an arc to form volatile products,—whereby relatively clean arcing chambers are insured.

Other objects and advantages of the invention will hereinafter appear.

My invention consists essentially in the provision of a material composed of silver and cadmium sulphide adapted for use in the form of switch contacts or the like. In practice the silver employed is in powder form, and to the silver powder I add from a trace up to 20 per cent by weight of cadmium sulphide, when the material is intended to be used for the formation of switch contacts.

According to another phase of my invention, up to 50 per cent of cadmium sulphide may be mixed with the silver powder, in order to reduce the cost of the material while retaining certain important advantages thereof. However, where the material is to be used in the form of switch contacts or contact tips I prefer that the quantity of cadmium sulphide in the composition shall not substantially exceed 20 per cent by weight of all the ingredients. Materials containing the aforementioned larger percentages of cadmium sulphide will preferably be employed to form arc interrupting elements or tips to be associated with the contacts of circuit breakers,—as distinguished from the current carrying contacts themselves.

In a preferred form of my invention I employ the following ingredients for the mixture in the proportions given, by weight:

	Per cent
Merck's precipitated silver powder	67
Crystalline silver powder of 80 mesh and finer	22
Cadmium sulphide	11

Merck's silver powder is a commercial product, and is of the precipitated type. It is characterized by a fibrous texture, extreme whiteness, and unusual ability to cold weld under pressure to a tough solid of considerable tensile strength.

In respect of the example just mentioned, it is to be understood that the crystalline silver powder may be omitted,—a corresponding percentage of Merck's silver powder being substituted therefor. However, I have found in practice that by the use of such crystalline silver powder, in about the percentage given, a molded contact of superior density is obtained. Such increased density of the material in the finished article has obvious advantages in respect of mechanical resistance to wear, and in respect of added resistance to pitting and/or transfer of the contact material normally resulting from arcing. At the same time, such pores as remain do not entrap gas, so that contacts composed of my improved material do not blister even if heated to redness.

Using the aforementioned preferred percentages of ingredients, I first grind the relatively coarse crystalline silver powder along with the cadmium sulphide, in a ball mill or the like, whereupon the Merck's silver powder is added and thoroughly mixed with the other ingredients until a homogeneous amorphous or powdery mass is obtained.

The aforementioned mass of mixture of pow-

dered ingredients is difficult to handle by mechanical volumetric measuring means, due to the poor and uncertain flow characteristics thereof, and heretofore it has been considered necessary to weigh out or otherwise manually measure the amount of material to be employed for each mold charge. However, due to the peculiar nature of the cadmium sulphide and its action relatively to the silver particles, I am enabled to effect formation of the mixed ingredients into granules of substantially any desired size by merely heating and tumbling the mixture on a wire mesh screen. The granules of the mixture may then be caused to flow by gravity under any suitable control means responsive either to volume or weight to effect proper charging of the mold cavities in any well known manner.

The mold charges are subjected to a relatively high molding pressure,—say, 40,000 pounds per square inch, either at room temperature, or, preferably, at a temperature of 400 degrees F.—which is much below the melting point of any of the ingredients. As aforeindicated, the cadmium sulphide has the peculiar property of wetting the particles of silver, and thus forms an excellent binder for the latter, whereas under the molding pressure the particles of cadmium sulphide are likewise welded to each other.

In practice my improved contact tips are molded directly onto supporting members or carriers formed of a base metal, such as copper.

Contact tips when produced in accordance with my invention are peculiarly free from the formation of debris as a result of arcing therebetween when in use. It is believed that this desirable result is due to the fact that any cadmium sulphide particles if dislodged or disintegrated by the arc are completely vaporized, so that no solid matter capable of forming the usual arc debris is thrown off.

Contact tips of the character herein disclosed are distinguished by their extremely high current controlling capacity, long life, and relative freedom from transfer or pitting. For example, in numerous tests conducted by me I have found that pairs or sets of such contacts are readily capable of going through at least 350,000 complete cycles, without serious transfer or pitting due to arcing, making 300 amperes and breaking 100 amperes, direct current. This very greatly exceeds the operative capacity of any known contact materials, as is evidenced by the fact that in a test of the character aforementioned the Government specifications merely require that the contact tips shall go 20,000 complete cycles of operation without serious transfer of the contact material.

Although at present I prefer to employ cadmium sulphide in the composition, it is to be understood that in carrying out my invention, other materials having the combination of properties afforded by cadmium sulphide, as above enumerated, may be substituted for the latter. For example, I may substitute for cadmium sulphide—zinc sulphide, silver sulphide, lead sulphide and the like.

I claim:

1. An electrical contact composed of silver and cadmium sulphide, the quantity of cadmium sulphide being not in excess of 20 per cent.

2. An electrical contact composed of precipitated silver powder and cadmium sulphide, the quantity of cadmium sulphide being not in excess of 20 per cent.

3. An electrical contact comprising silver powder of a fibrous texture as the principal ingredient and including a quantity of cadmium sulphide not in excess of 20 per cent by weight of said ingredients.

4. An electrical switch element composed of silver and a trace up to 50 per cent of cadmium sulphide.

5. An electrical switch element composed of precipitated silver powder and a trace up to 50 per cent of cadmium sulphide.

6. An electrical contact composed of precipitated silver powder of a fibrous texture as the principal ingredient and including a trace up to 20 per cent of cadmium sulphide.

7. An electrical contact composed of silver and about 11 per cent by weight of cadmium sulphide, said contact being characterized by freedom from arc-formed debris as an incident to normal use thereof.

8. A pressure molded electrical contact composed of a homogeneous mixture of silver powder and about 11 per cent of cadmium sulphide.

9. An electrical contact pressure molded from a homogeneous mixture of materials comprising about 67 per cent of Merck's precipitated silver powder, about 22 per cent of a crystalline silver powder of 80 mesh and finer, and about 11 per cent of cadmium sulphide.

10. An electrical contact pressure molded from a granular material consisting of a homogeneous mixture of about 89 per cent of precipitated silver powder and about 11 per cent of cadmium sulphide.

11. An electrical contact material comprising a homogeneous mixture of precipitated silver powder and from a trace up to 20 per cent by weight of cadmium sulphide, said mixture being further characterized by its reduction to granules of the desired size for molding as an incident to heating and tumbling thereof.

12. An electrical contact adapted for use without sintering, comprising a homogeneous mixture of precipitated silver powder and about 11 per cent by weight of cadmium sulphide, said mixture being characterized by the ability of said cadmium sulphide to wet the silver particles and act as a binder for the latter when said mixture is subjected to a molding pressure.

13. An electrical switch contact adapted to be pressure molded in situ upon a suitable base metal support, said contact consisting of a substantially homogeneous mixture of about 67 per cent of Merck's precipitated silver powder, about 22 per cent of a crystalline silver powder of approximately 80 mesh and finer, and about 11 per cent of cadmium sulphide, said contact being characterized by its adaptability for normal use thereof with sintering and by its freedom from arc-formed debris as an incident to such normal use.

14. A cold molded electrical switch element of relatively great density adapted for use without sintering thereof, said element being formed from granules each consisting of a substantially homogeneous mixture of a quantity of silver powder of fibrous texture, a quantity of crystalline silver powder of 80 mesh and finer, and a quantity of cadmium sulphide, the quantity of cadmium sulphide being not in excess of 50 per cent.

15. A cold molded electrical switch contact of relatively great density adapted for use without sintering thereof, said contact being formed from granules each consisting of a substantially homogeneous mixture of a quantity of silver powder of

fibrous texture, a quantity of crystalline silver powder of 80 mesh and finer, and a quantity of cadmium sulphide, the quantity of cadmium sulphide being not in excess of 20 per cent.

16. A cold molded electrical switch contact of relatively great density adapted for use without sintering thereof, said contact being formed from granules each consisting of a substantially homogeneous mixture of a quantity of silver powder of fibrous texture, a quantity of crystalline silver powder of 80 mesh and finer, and a quantity of cadmium sulphide, the first mentioned quantity of silver powder being about 67 per cent, the second mentioned quantity of silver powder being about 22 per cent, and the quantity of cadmium sulphide being about 11 per cent.

17. A cold molded electrical switch contact comprising an unalloyed composition containing conductive components and anti-flux components, the anti-flux components being characterized by their ability to wet the surfaces of the conductive components and act as a binder therefor, whereby the contact is adapted for use without sintering thereof; said anti-flux components being further characterized by their thermal stability at temperatures up to 1000 degrees F.; and said anti-flux components being still further characterized by their ability to dissociate at the arcing surface into one or more volatile products, thus maintaining said arcing surface of substantially constant composition and substantially constant contact resistance as the contact wears, whereby the amount of arc debris deposited in the arc chamber is reduced to a minimum.

18. An electrical switch element composed of precipitated silver powder, said silver powder being characterized by its fibrous texture, extreme whiteness, and unusual ability to cold weld under pressure to a tough solid of considerable tensile strength, and a trace up to 50 per cent of cadmium sulphide.

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